10 – Jasper
Exceptional Events Detail

Parameter: $PM_{2.5}$

Dates: May 23 - 30, 2007

Location: Jasper / Dale – Dubois / Spencer Co.

Event: Smoke from wildfires in northern Florida and southern Georgia impacted the Southwest Indiana region during the period of May 23 – 30. The gradual buildup of smoke moving through the area during this period resulted in exceedances of the 24-hour $PM_{2.5}$ NAAQS on May 26 and May 29 at Jasper Post Office (180372001). Higher values were also recorded at the Post Office on the other dates during this time period and at the Jasper – Sport Complex Site (180270004) on May 24 and May 27, and at the Jasper – Golf Course Site (180370005) and Dale (181470009) on May 24, 27, and 30.

Data: Different analyses of the data are used to demonstrate that the $PM_{2.5}$ concentrations measured from May 23 - 30 are beyond the range of values typically found during that time period and that they have been influenced by outside events. Table 10.1 shows daily $PM_{2.5}$ averages prior to, during and after the event with the values flagged in **bold**. Data have been flagged with an exceptional event flag of 'E' in AQS, awaiting concurrence from EPA.

Tables 10.2 and 10.3 list summaries of the data collected at the Jasper Post Office since 2000. Data from 2007 are calculated with all current data and with the flagged data removed. There is an improvement in the status of the area as the Daily Design Value for the 2005-2007 time period goes from 36 (nonattainment) to 35 (attainment). As Jasper Sport and Jasper Golf have collected data for only two years, no historical trend data are available and no long term analysis is possible. The values from these two sites correlate very well with the Post Office site and all sites are within three (3) miles of each other. All sites are in the same air mass and any conclusions of data from the Post Office are the same as for the other two sites.

The $PM_{2.5}$ data from Dale show a decrease in the annual average and the annual design value, but no change in the daily design value.

The values recorded during the May 23 – 30 time period are outside the normal values collected during the month of May. Prior to this time, the highest value reported in May had been 26.7 ug/m3 and the highest monthly average had been 15.49 ug/m3. With the high data collected in May 2007, the highest value was 41.5 ug/m3 and the monthly average was 20.4 ug/m3. Removing the flagged data results in a maximum daily concentration of 26 ug/m3 and an average concentration of 15.73 ug/m3. These values are much more in line with historical data. The May comparison data are in Table 10.4.

Table 10.1 - FRM Daily Values
Exceptional Event Period

Values in **BOLD** are flagged as exceptional events

Date	Jasper Post Office 18-037-2001	Jasper Sport 18-037-0004	Jasper Golf 18-037-0005	Dale 18-037-0005
5/17	6.1			
5/18	6.4	6.5	6.2	7
5/19	11.2			
5/20	12.2			
5/21	No sample	15.4	16.5	17
5/22	21.9			
5/23	**28.4**			
5/24	**25.0**	**25.7**	**26.5**	**25.5**
5/25	**25.9**			
5/26	**41.5**			
5/27	**30.5**	**30**	**30**	**30.5**
5/28	**34.2**			
5/29	**39.5**			
5/30	**31.8**	No Sample	**33.1**	**31.2**
5/31	No Sample			
6/1	21.5			
6/2	No Sample	22.8	20.2	23.8

Table 10.2 – Historical Daily Values

Year		Jasper - Post Office 18-037-2001		Dale 18-147-0005	
		98th %ile	Daily Design Value[1]	98th %ile	Daily Design Value[1]
2000		40		43.4	
2001		39		28.2	
2002	2000-2002	36.3	28	27.8	33
2003	2001-2003	39.5	38	34.6	30
2004	2002-2004	20	35	25.2	29
2005	2003-2005	41.2	37	39.7	33
2006	2004-2006	31.6	34	27.7	31
2007	2005-2007	34.7	36	31.4	33
		Values excluding flagged data			
2007	2005-2007	31	35	31.4	33

[1]Daily Design Value = 3 year average of annual 98th %ile values.

Table 10.3 - Historical Annual Averages

Year		Jasper - Post Office 18-037-2001		Dale 18-147-0005	
		Annual Ave.	Annual Design Value[2]	Annual Ave.	Annual Design Value[2]
2000		17.16		16.32	
2001		16.54		14.52	
2002	2000-2002	16.34	16.7	14.06	15
2003	2001-2003	15.72	16.2	14.63	14.4
2004	2002-2004	14.42	15.5	12.17	13.6
2005	2003-2005	16.92	15.7	16.76	14.5
2006	2004-2006	13.54	15	12.78	13.9
2007	2005-2007	14.39	14.9	14.13	14.6
		Values excluding flagged data			
2007	2005-2007	13.95	14.8	13.74	14.4

[2]Annual Design value = 3 year average of the annual averages.

Table 10.4 – Examination of Daily Maximums and Averages for May Monitored Values for 2000-2007 (Jasper Post Office)

Year	Maximum Values	Monthly Averages
2000	22.2	15.49
2001	26.7	14.76
2002	No Data	No Data
2003	15.9	11.14
2004	22.1	13.37
2005	22.1	14.08
2006	21.5	9.94
2007	41.5	20.4
Values with flagged data removed		
2007	26	15.73

Particulate Composition: Speciation data are collected at the Jasper Post Office site on a one in six day sampling schedule. Data are available for May 24 and May 30. High organic carbon values were reported on those two dates; 6.9 ug/m3 and 10.7 ug/m3 respectively. These values were the highest and the fourth highest values of the year. The annual average for organic carbon at this site is 3.95 ug/m3. There was no increase in the elemental carbon values; 0.5 ug/m3 and 0.3 ug/m3, on the two dates, as compared to the annual average of 0.55 ug/m3. The time progression of the maps in Appendix 3 shows the rise and fall of the organic carbon values across the region over this time period.

Maps: Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires comes into southern Indiana on May 23 and continues to influence the atmosphere until May 30. The daily wind roses (obtained from the nearest meteorological site at Jasper Sport, 18-037-0004) show information on prevailing wind direction, calm conditions and wind speed NOAA weather maps are also used to show that an upper level trough greatly influences the direction of the plume in relation to the SW Indiana region.

Trajectory Modeling: The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the site (latitude: 38.39°; longitude:-86.93°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough

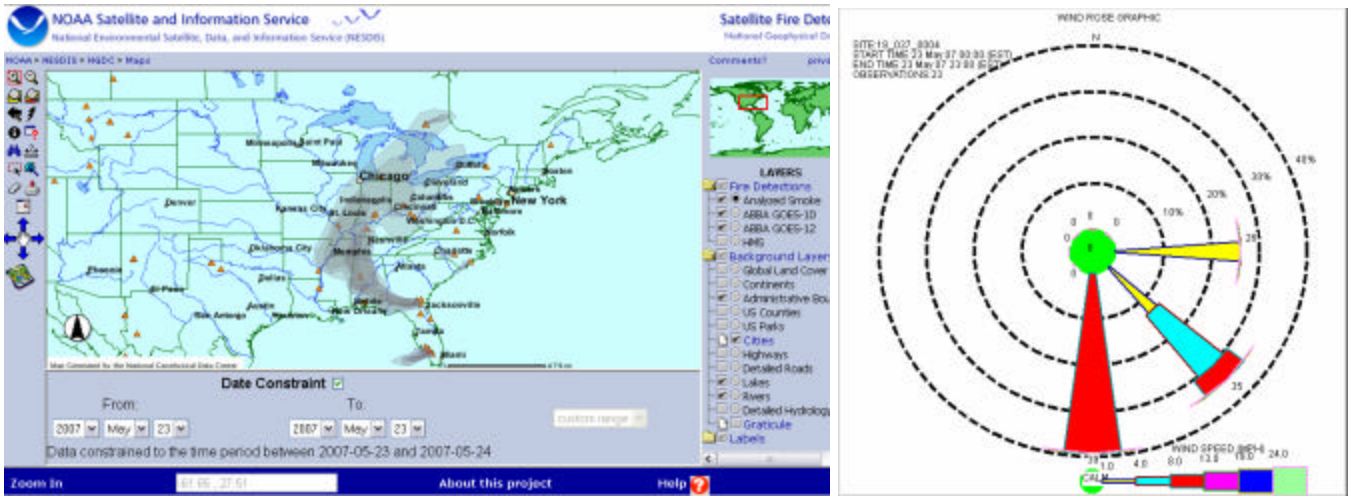
to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. These models are in Appendix 2. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. For example, May 24, 26, and 29 show a very narrow channel of air flow between southeastern Georgia and southwestern Indiana. Both the backward and forward trajectories confirm this. In addition, other days during the event in question show similar results although those trajectories are not shown here.

Conclusion: EPA defines an "exceptional event" as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. The various analyses show that the high $PM_{2.5}$ concentrations observed at the Jasper and Dale sites from May 23, 2007 through May 30, 2007 are coming from the wildfires in southern Georgia and northern Florida. Indiana had no control over this event. According to 40 CFR Part 50.14 (b)(1), "EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State demonstrates to EPA's satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section." IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the 'E' flag on the data in AQS for the data in **bold** in Table 10.1.

Daily Smoke Maps and Weather Conditions

The smoke map shows that the plume has reached the Jasper area and as shown in Table 10.1, $PM_{2.5}$ levels have started to increase. The corresponding wind rose and weather map further illustrate the direction of the plume by the location of the upper level trough (orange dashed line) and the S, SE prevailing winds.



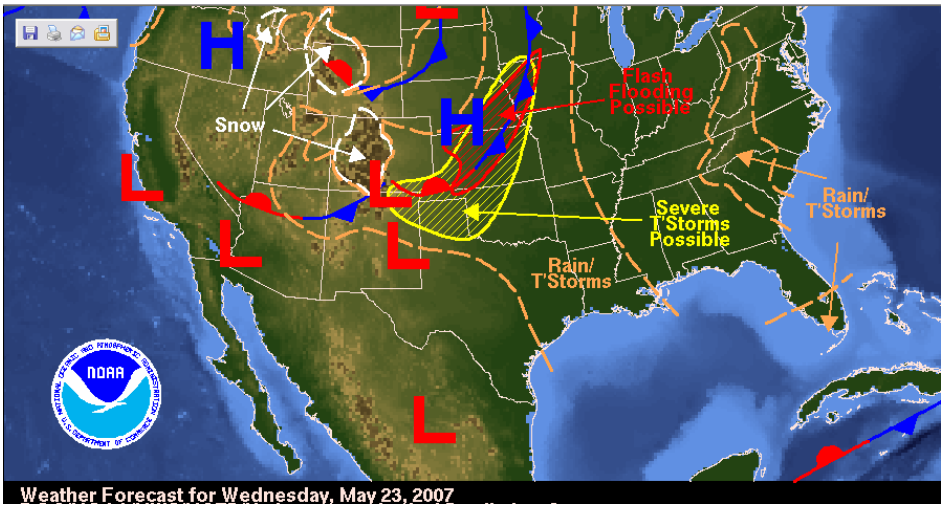
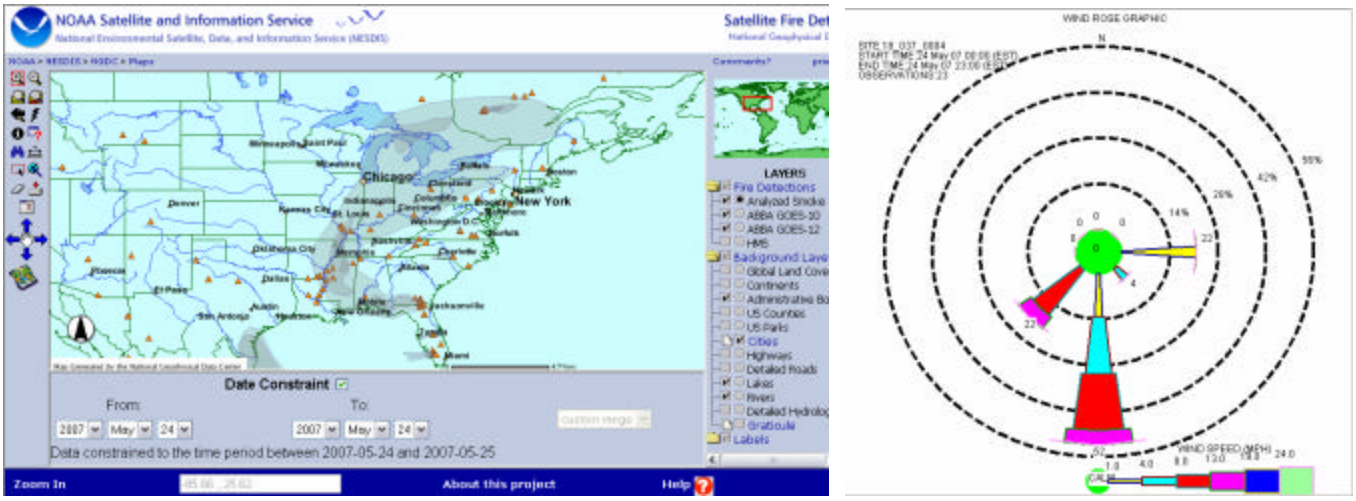


Figure 10.1 - May 23, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction has shifted to the SSW as the upper level trough moves further to the east and another trough develops over Ohio, keeping the plume over the SW Indiana region.



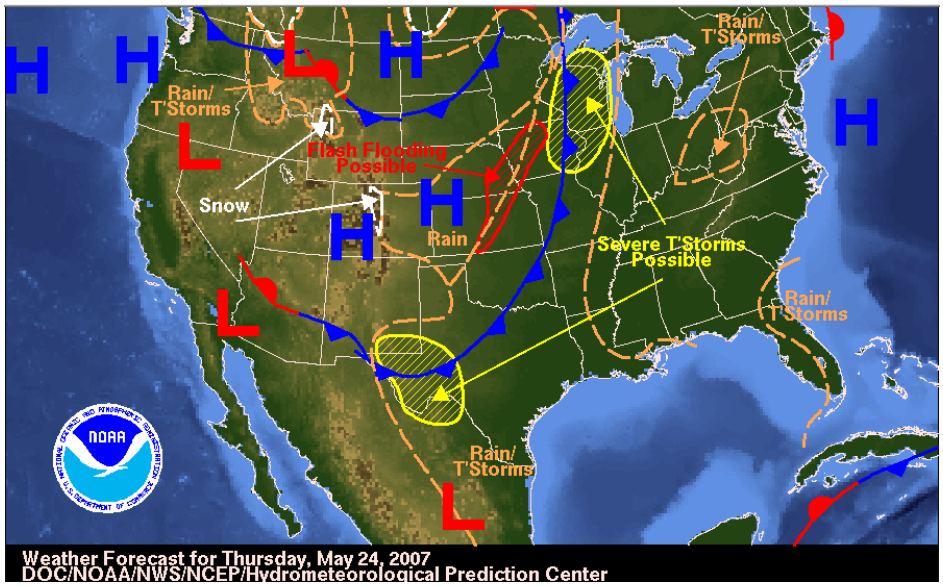


Figure 10.2 - May 24, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction continues to be from the south as the upper level trough has now moved directly over the SW Indiana region.

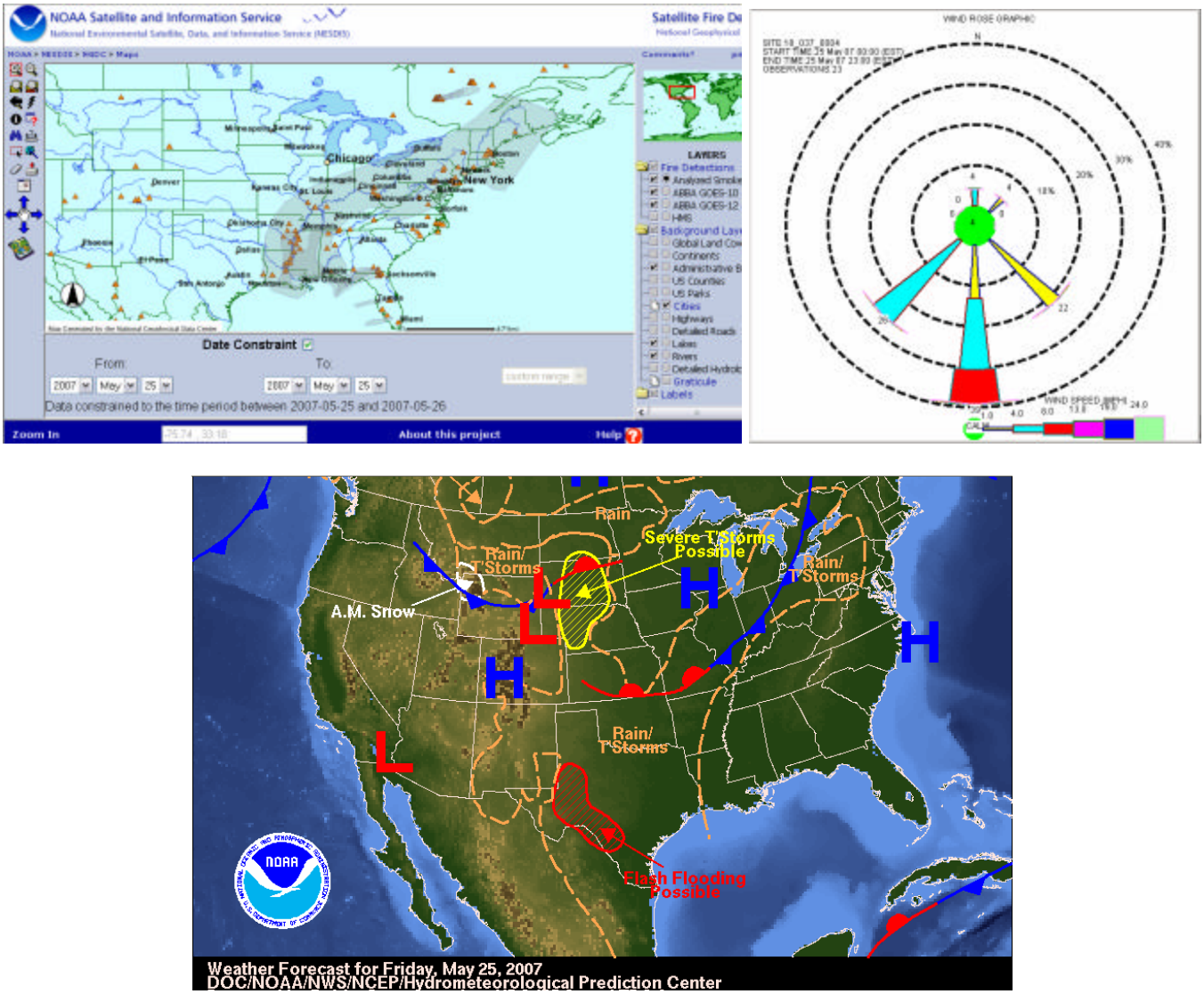
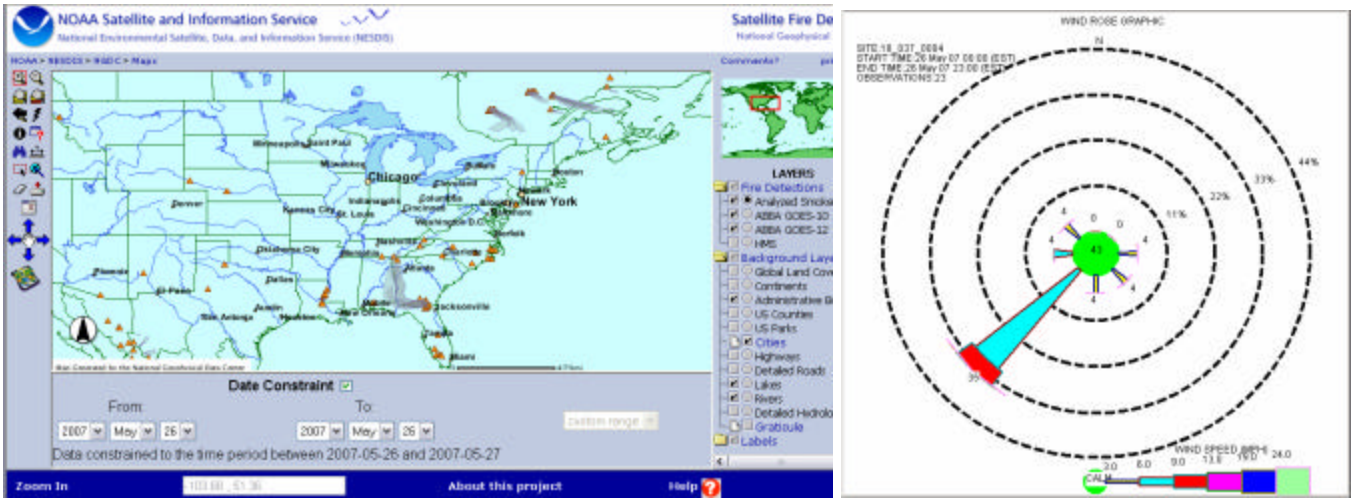


Figure 10.3 - May 25, 2007

The smoke map illustrates that the plume has essentially dissipated as the trough keeps the smoke pushed to the south. However, due to the prevailing calm wind conditions the stagnant air mass continues to cause the $PM_{2.5}$ levels to rise past the 24-hour standard.



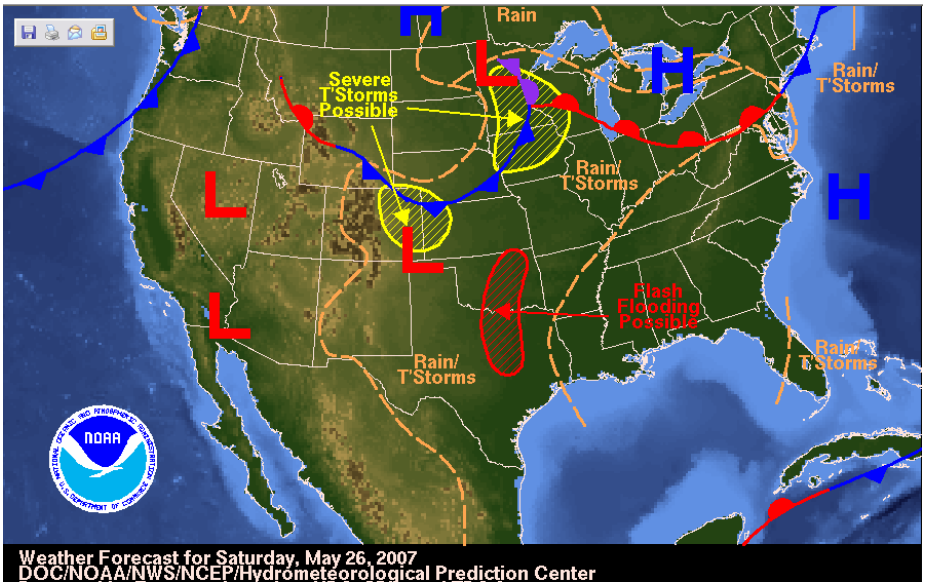


Figure 10.4 - May 26, 2007

The smoke map illustrates that the plume continues to stall as the trough continues to keep the smoke pushed to the south. However, due to the predominately calm wind conditions the stagnant air mass continues to cause the $PM_{2.5}$ levels to remain elevated.

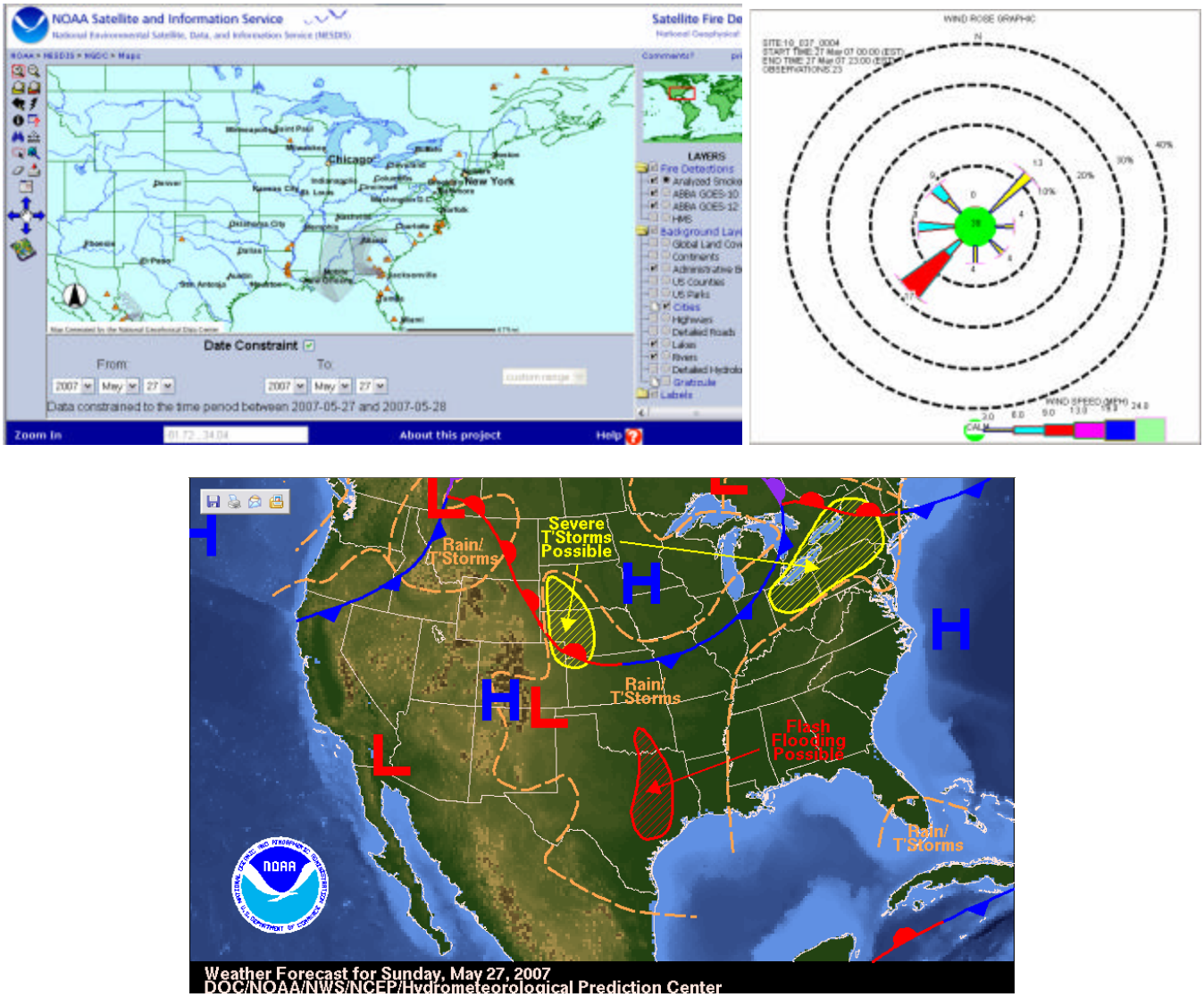
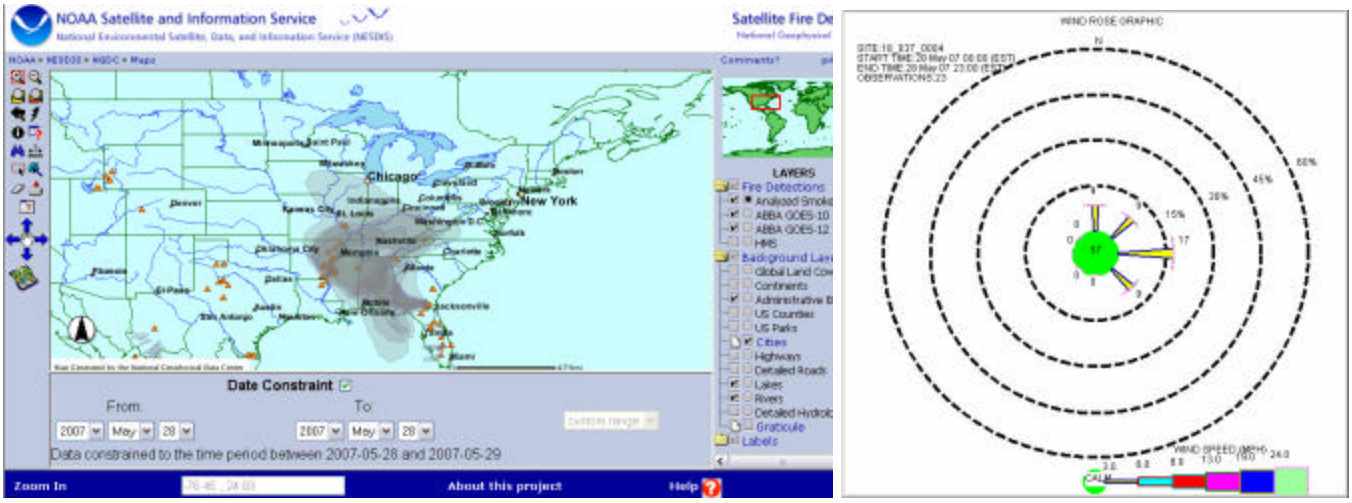


Figure 10.5 - May 27, 2007

The smoke map shows the plume has been pushed back into the region due to the upper level trough moving to the north and causing the plume to become more concentrated over the area.



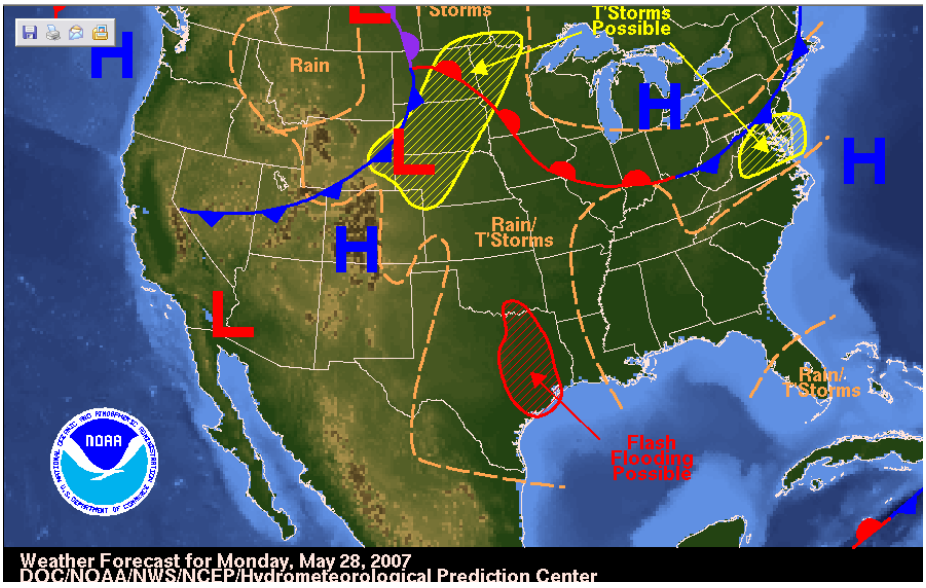
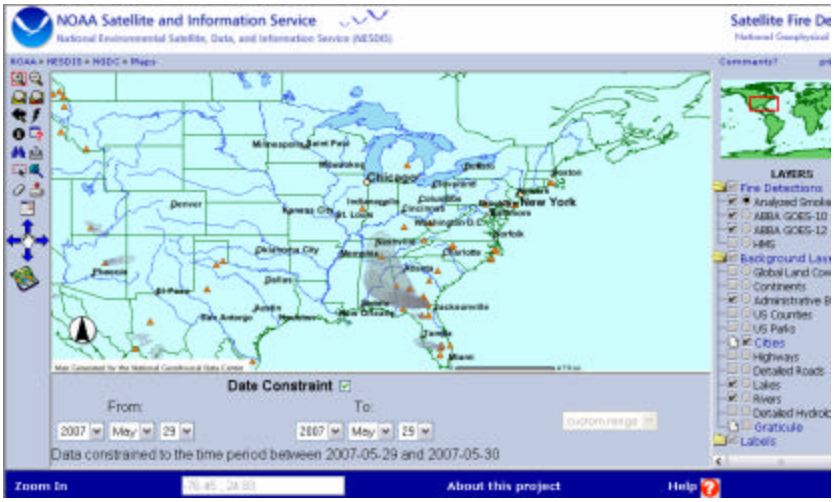
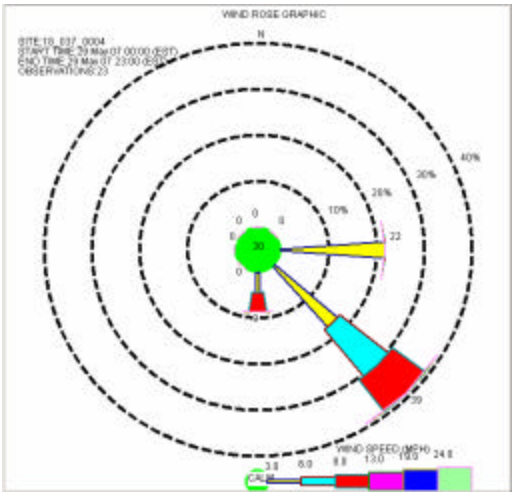


Figure 10.6 - May 28, 2007

Although the map illustrates the plume is not over the region, the prevailing SE wind direction, as shown by the wind rose, keep the high levels of $PM_{2.5}$ over the area.





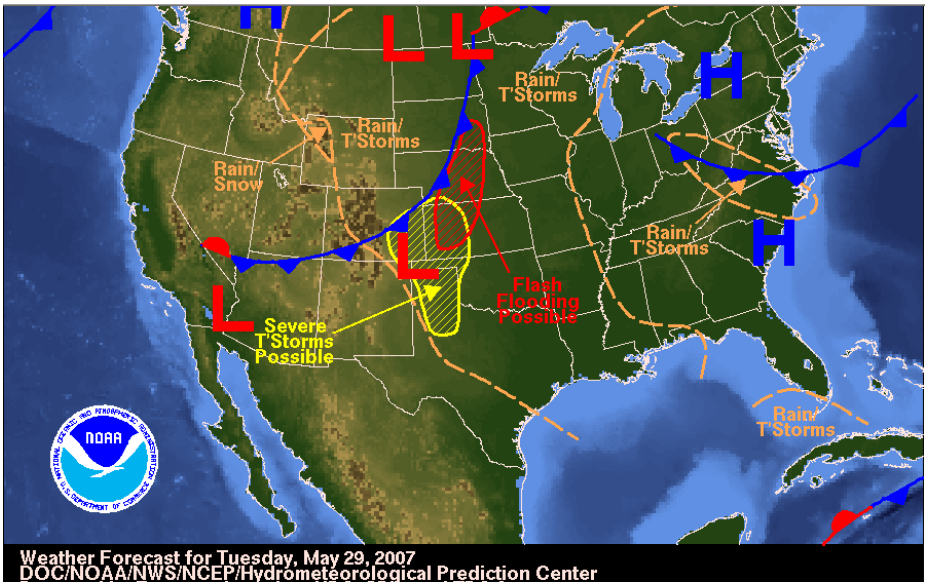


Figure 10.7 - May 29, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be from the S, SE.

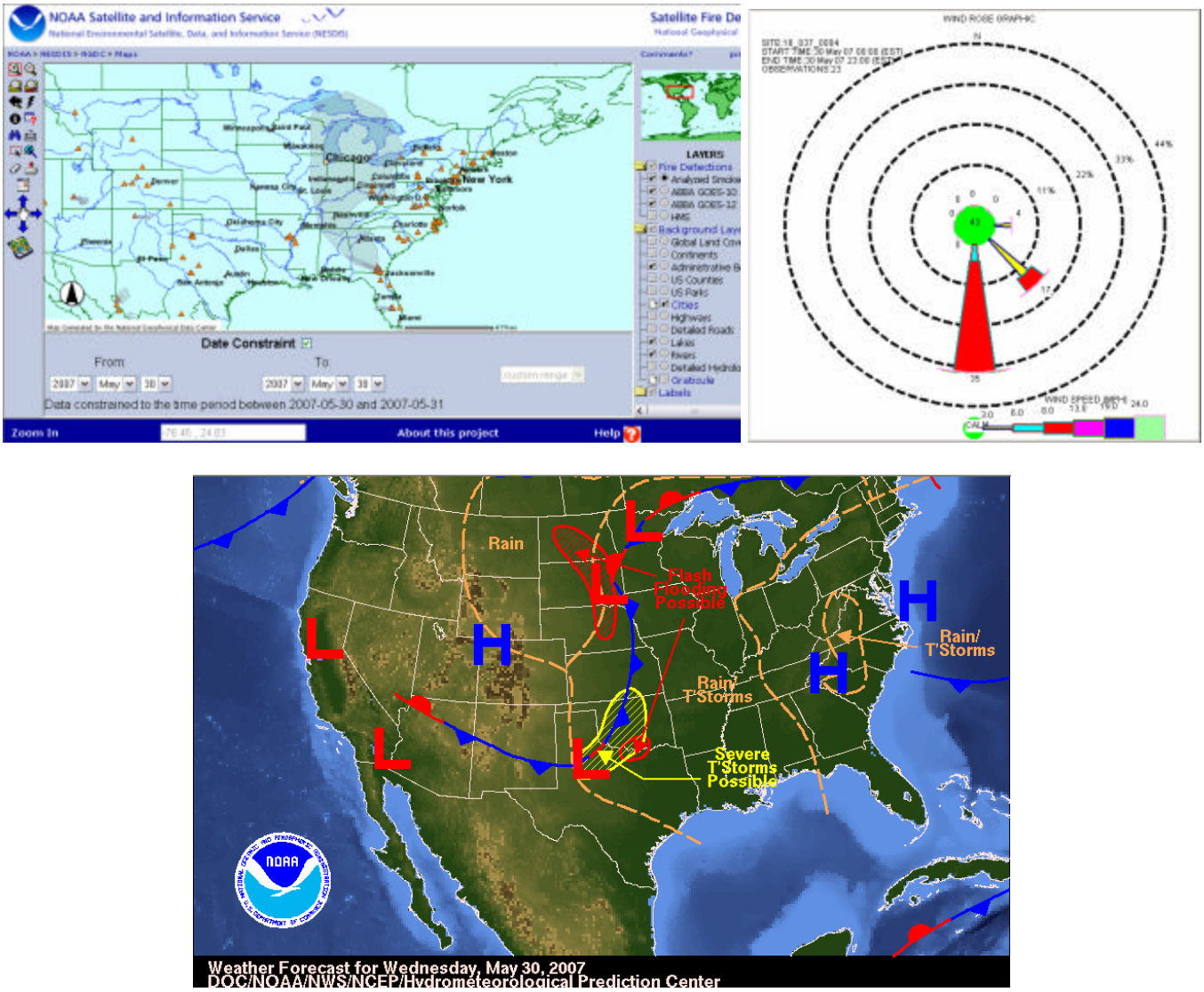
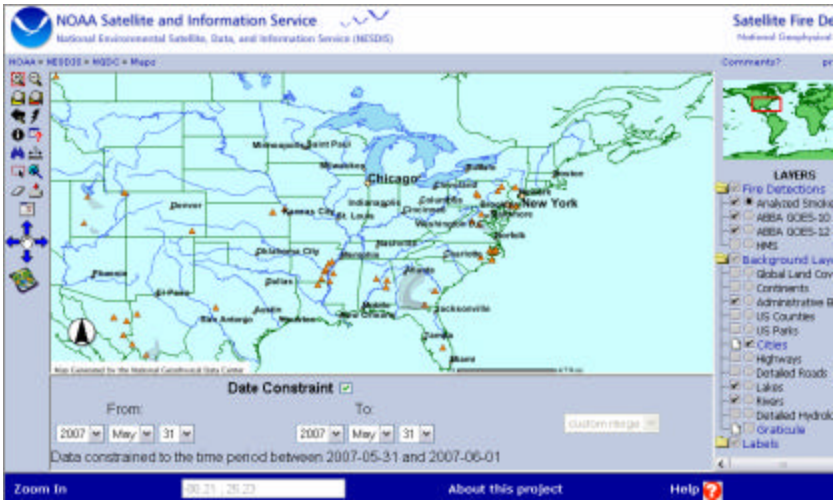
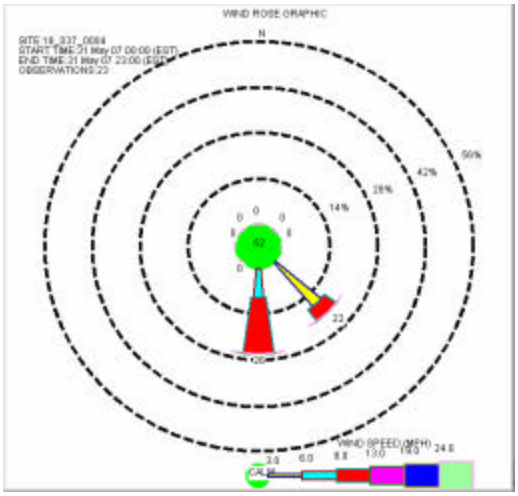


Figure 10.8 - May 30, 2007

The map shows the plume has dissipated as the upper level trough and increased wind speed have pushed the remaining smoke toward the east and out of the region.





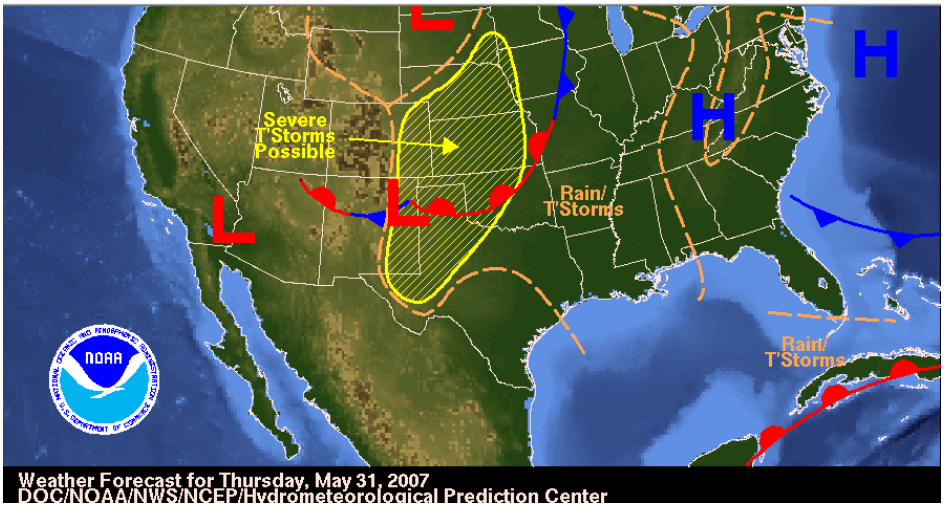


Figure 10.9 - May 31, 2007

Backward Trajectory Models

NOAA ARL READY HYSPLIT Maps

Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (http://www.arl.noaa.gov/ready/hysplit4.html). NOAA Air Resources Laboratory, Silver Spring, MD.

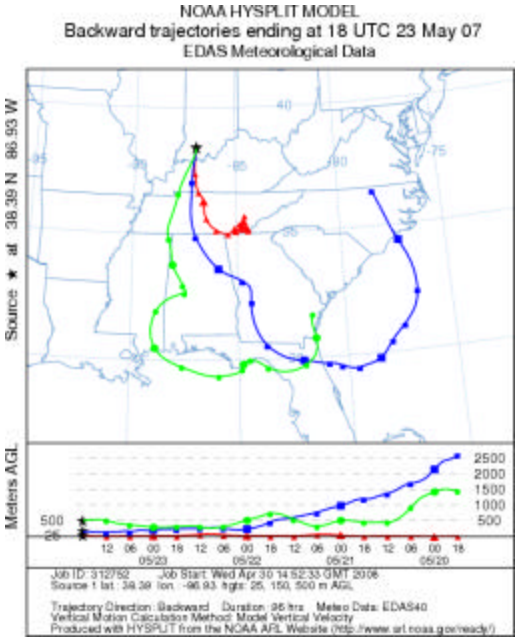


Figure 10.10: Backward trajectories originating from Jasper on 5/23/07 at 12:00 PM CST showing consistency in the air mass passing over northern Florida.

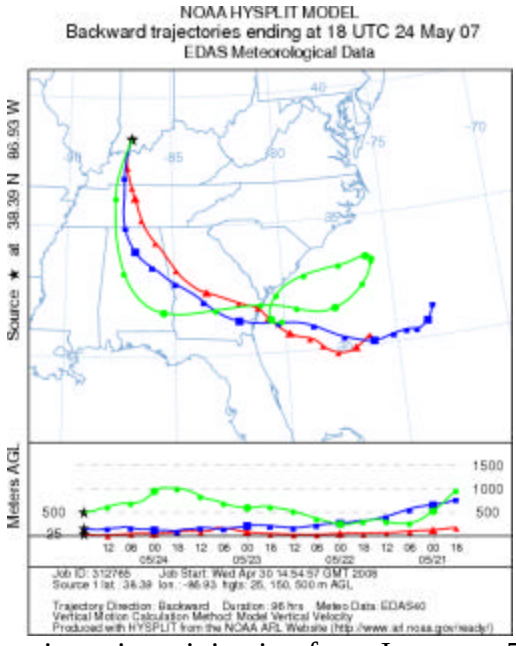


Figure 10.11: Backward trajectories originating from Jasper on 5/24/07 at 12:00 PM CST showing continuation of the air mass passing over southern Georgia.

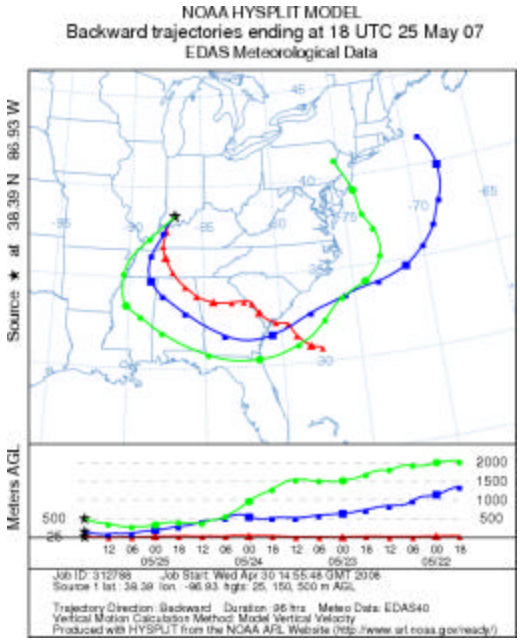


Figure 10.12: Backward trajectories originating from Jasper on 5/25/07 at 12:00 PM CST showing the air mass still passing over southern Georgia.

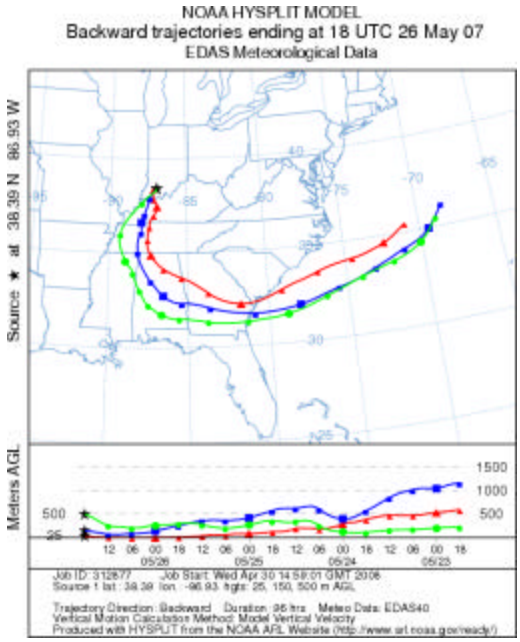


Figure 10.13: Backward trajectories originating from Jasper on 5/26/07 at 12:00 PM CST showing the air mass still passing over southern Georgia.

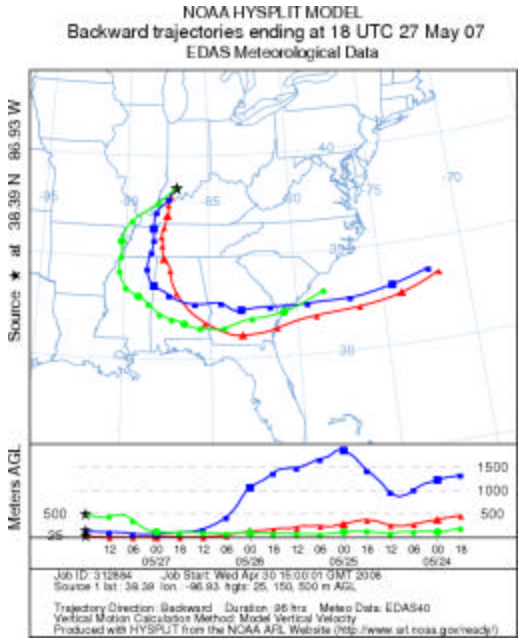


Figure 10.14: Backward trajectories originating from Jasper on 5/27/07 at 12:00 PM CST still showing consistency in the air mass passing over southern Georgia.

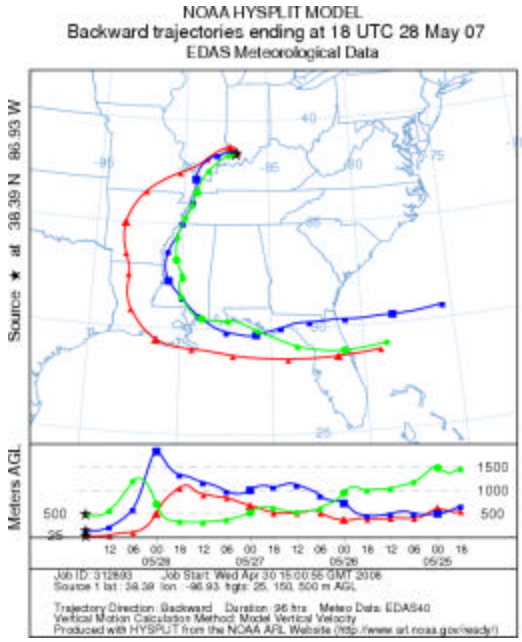


Figure 10.15: Backward trajectories originating from Jasper on 5/28/07 at 12:00 PM CST showing the air mass passing over northern Florida.

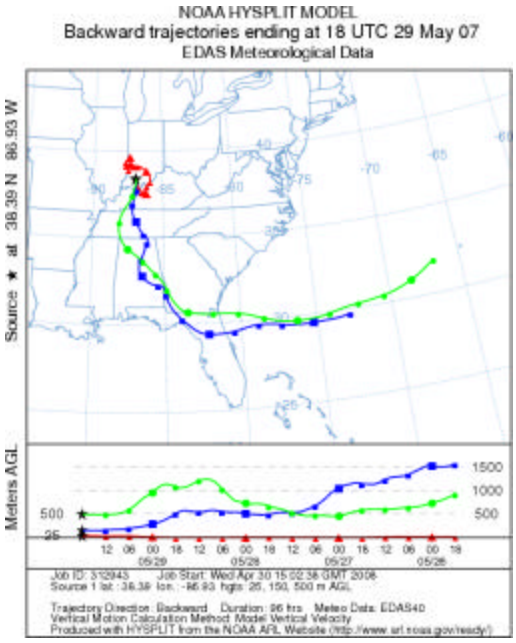


Figure 10.16: Backward trajectories originating from Jasper on 5/29/07 at 12:00 PM CST showing the air mass passing over northern Florida and southern Georgia. Note: the lowest-level trajectory breaks down due to the model predicting a zero elevation air mass.

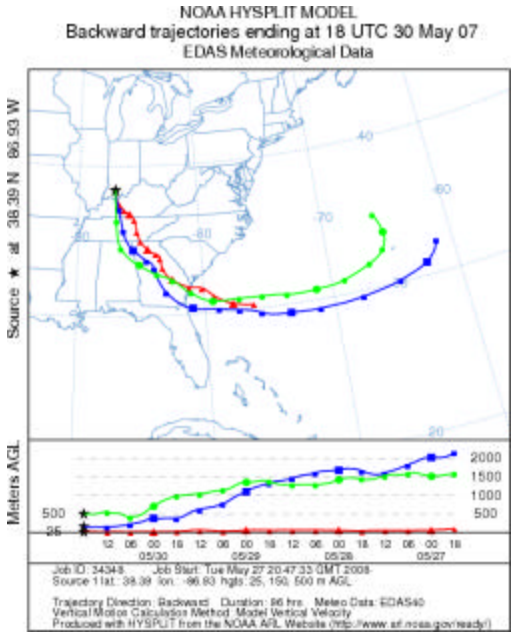


Figure 10.17: Backward trajectories originating from Jasper on 5/30/07 at 12:00 PM CST showing the air mass still passing over Georgia.